

Creating Purposeful Partnerships

BUSINESS AND HIGHER EDUCATION WORKING TOGETHER TO BUILD REGIONAL
TALENT ECOSYSTEMS FOR THE DIGITAL ECONOMY



ABOUT BHEF

The Business-Higher Education Forum (BHEF) is the nation's oldest membership organization of Fortune 500 CEOs, college and university presidents, and other leaders dedicated to the creation of a highly skilled future workforce. BHEF members collaborate and form strategic partnerships to build new undergraduate pathways; improve alignment between higher education and the workforce; and produce a diverse, highly skilled talent pool to meet demand in emerging fields.

ACKNOWLEDGEMENTS

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JOIN US IN CREATING SOLUTIONS

CREATING PURPOSEFUL PARTNERSHIPS offers insights into business-led regional talent ecosystems that facilitate access, alignment, and development of a prepared workforce with the skills necessary for companies' long-term success. The findings of this report serve as a playbook for CEOs and their executive teams for establishing purposeful and strategic partnerships with higher education leaders to meet the need for diverse digital-skills talent.

This report builds upon the Business-Higher Education Forum's (BHEF) work, supported by a five-year grant from the National Science Foundation, to develop, replicate, and evaluate a successful model for such partnerships between businesses and higher education institutions. These partnerships begin with industry and higher education working together to deeply understand, articulate, and translate the workforce needs of a particular region. This level-setting activity, aided by a third-party facilitator (in this case, BHEF), creates the necessary foundation for developing partnerships that lead to new educational pathways, job credentials, and talent-acquisition strategies—and, ultimately, employees with the skills that companies need. This report focuses on the deployment, development, and learning across the five sites supported through the NSF grant.

BHEF is a nonprofit membership organization comprised of the nation's leading business executives and university presidents. We use market intelligence to create business-higher education partnerships and innovative talent solutions in high-demand and emerging fields. These partnerships and talent solutions create essential, impactful, and long-lasting student pathways that align higher education with the evolving needs of today's workforce. BHEF members are leaders in developing strategic partnerships that transform higher education programs to meet the emerging talent demands of employers and increase the number and diversity of graduates with 21st-century skills.

Through this report, BHEF is sharing lessons and insights from effective partnership models, demonstrating the application of digital skills in different emerging fields and outlining best practices for creating diverse regional talent ecosystems. We hope the report will inspire you to take action and build strategic business-higher education partnerships to jointly develop the digitally skilled workers your own region needs.



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Our nation faces significant challenges in aligning what students are learning in college with the skills and talents they need to be successful at work. Business-higher education partnerships are a powerful tool to meet the demand for diverse STEM talent in the 21st-century digital economy.

INTRODUCTION

THROUGH THE COLLABORATION of its business and higher education members, the Business-Higher Education Forum (BHEF) creates innovative talent solutions in high-demand and emerging fields to help meet the evolving needs of today's workforce. Our nation faces significant challenges in aligning what students are learning in college with the skills and talents they need to be successful at work. Exacerbating the problem, we frequently see too many college students drop out or transfer out of important STEM fields. Business-higher education partnerships are a powerful tool to meet the demand for diverse STEM talent in the 21st-century digital economy, where a baccalaureate degree and skills in digital convergence disciplines such as data science and analytics (DSA) and cybersecurity, are increasingly vital job requirements.

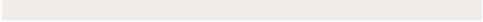
This report presents meaningful examples that CEOs and their senior executives can use as models for taking action. Each example illustrates how a company, through executive-level engagement, can partner with a higher education institution and other businesses or stakeholders in a region to form solutions to meet the growing demand for digital-skills talent. To accomplish this requires an intentional and rigorous process that moves business-higher education partnerships from transactional to strategic relationships.

This report shares BHEF's Partnership Implementation Process, which guides business and higher education partners on how to align their efforts to meet the workforce needs in greatest demand. Through this process, BHEF helps develop and replicate the most effective business-higher education partnerships, those that offer innovative programs to build digital skills and improve student outcomes, including community college transfer, across multiple regions. The partnerships highlighted in this report demonstrate best practices and suggest ways that all types of businesses can deeply engage with universities to establish diverse talent ecosystems in their region.



—THE— MISMATCH

BETWEEN POSTSECONDARY EDUCATION AND EMPLOYER NEEDS



Over the past two decades, the expansion of digital technologies to companies in non-technology sectors has created a hybrid economy. A wide variety of different types of companies have increasingly become digital-intensive organizations, changing their business models and talent needs. According to Burning Glass Technologies, hybrid jobs in a hybrid economy require a new combination of skills in a diversity of fields. In particular, literacy in cybersecurity and data science and analytics, known as digital convergence disciplines, have become necessary skillsets in many occupations. These emerging fields are interconnected and evolving at an accelerating pace.

69%

OF EMPLOYERS EXPECT
CANDIDATES WITH DATA
SCIENCE AND ANALYTICS
SKILLS BY 2021

2.7M

POSITIONS FOR DATA AND
ANALYTICS IN THE UNITED
STATES BY 2020

33%

OF THE DATA SAVVY
PROFESSIONAL JOB MARKET
WILL BE FOR DATA-DRIVEN
DECISION MAKERS

209K

CYBERSECURITY POSITIONS
WENT UNFILLED IN 2015

\$4M

AVERAGE COST OF A DATA
BREACH FOR A COMPANY

DIGITAL CONVERGENCE DEFINITION

Digital convergence represents fields that have emerged through the expanding digital economy, such as cybersecurity, data science and analytics, and AI/machine learning. These fields require talent across a spectrum of capabilities, as well as an integrated set of digital skills that can benefit employees at all levels.

LABOR MARKET TRENDS AND NEEDS IN DATA SCIENCE AND ANALYTICS

According to BHEF's 2017 reports, *The Quant Crunch: How the Demand for Data Science Skills Is Disrupting the Job Market*, developed in partnership with Burning Glass Technologies and IBM, and *Investing in America's Data Science and Analytics Talent*, developed in partnership with PwC and informed by a Burning Glass Technologies workforce analysis and real-time survey data from Gallup:

By 2021, **69 percent of employers expect candidates with data science and analytics skills** to get preference for jobs in their organizations. Yet only 23 percent of college and university leaders say their graduates will have those skills.

By 2020, the number of positions for data and analytics talent in the United States will increase by 364,000 openings to 2,720,000.

In 2020, **job openings for data scientists and similar advanced analytical roles will represent just 2 percent of the projected demand** across all job roles requiring data and analytics skill.

Demand for data-driven decision makers will compose one-third of the data savvy professional job market, with a projected increase of 110,000 positions by 2020.

LABOR MARKET TRENDS AND NEEDS IN CYBERSECURITY

BHEF's 2017 reports, *Understanding Cybersecurity Talent Needs: Findings from Surveys of Business Executives and College Presidents* and *Invest to Improve: The Cybersecurity Talent Deficit*, which combines data from a Gallup survey, jobs analyses from Burning Glass Technologies, and detailed student demographic and wage data, found that:

Approximately **209,000 cybersecurity positions went unfilled in 2015**, and demand is expected to continue to grow.¹

Seventy-one percent of employers have incurred damages because of this deficit, including data loss and targeting by hackers.²

The average cost of a data breach for a company is \$4 million.³

Only 25 percent of business executives strongly agree that their company can **effectively respond to a cyber-attack**.

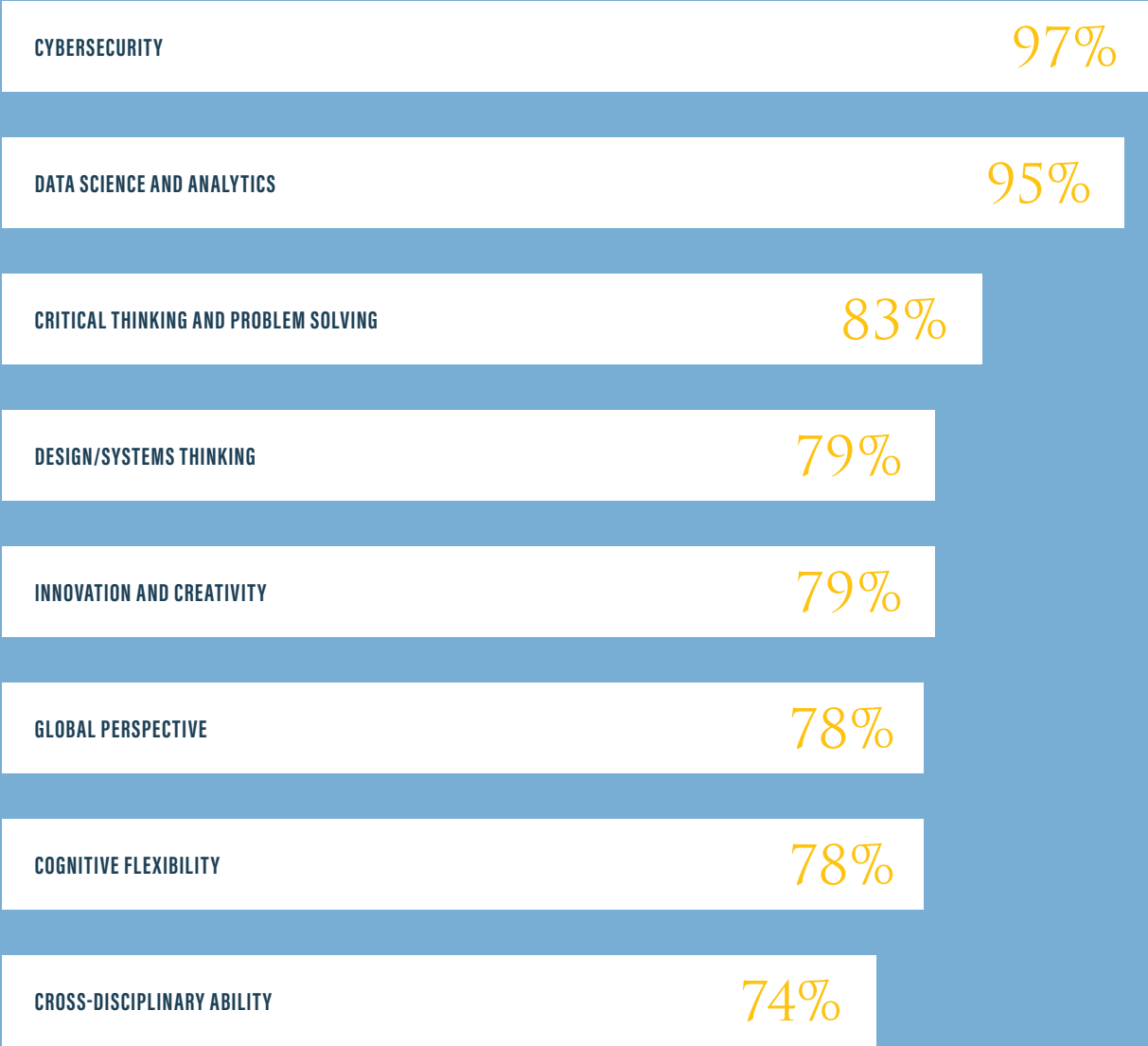
1. Demand to Fill Cybersecurity Jobs Booming, Ariha Setalvad, March 31, 2015.

2. Hacking the Skills Shortage: A study of the international shortage in cybersecurity skills, Center for Strategic and International Studies, 2016.

3. 2016 Cost of Data Breach Study: Global Analysis, Ponemon Institute, 2016.

In partnership with the Business Roundtable, BHEF also released a 2017 survey on the future of the workforce that revealed that two of the hardest to hire skills identified by employers were cybersecurity and DSA, ahead of even critical thinking and problem solving (see Figure. 1 below).

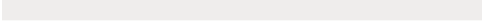
FIG.1 HARDEST TO HIRE SKILLS



A woman and a man are sitting at a desk in a server room, looking at a document together. The woman is on the left, wearing a white shirt and a lanyard. The man is on the right, wearing a light blue shirt. They are both looking down at the document. In the background, there are server racks with many cables hanging from them. The entire image has a blue tint.

—A— PLAYBOOK

FOR PURPOSEFUL PARTNERSHIPS



Business engagement can help improve student retention in STEM fields, but little is known about the specific contributions that businesses can make—particularly among STEM transfer students. The lack of alignment between higher education and business is a result of individual, siloed attempts to address issues rather than a holistic top-down approach. Resolving that misalignment requires a curated process that efficiently and effectively articulates the workforce demands of the 21st-century digital economy.

THE KEY DRIVERS OF THAT PROCESS are strategic business-higher education partnerships that establish seamless pathways for students to high-demand careers. Work-based learning experiences that companies offer students—including apprenticeships, internships, co-operative education, and other forms of work closely tied to academic and career success—have been shown to be most effective in bridging the gap between the supply of available talent and the employees with the skills that today's industries need. Such experiences significantly increase student learning, career readiness, and persistence to degree—particularly among women and members of underrepresented minority groups.

According to a June 2017 Education and Workforce survey by the Business Roundtable, 80 percent of companies are already establishing and building public-private partnerships regarding workforce training or skills development to remediate talent gaps, predominantly through work-based learning programs such as internships and co-operative education. The survey also found that members of the Business Roundtable, an association of chief executive officers of America's leading companies, who participated in curriculum development programs were less likely to view their company's skills shortages as problematic or very problematic. Only 27 percent of CEOs who were engaged in such programs viewed it as problematic, compared to 54 percent of those who were not engaged. These findings emphasize the importance for CEOs to engage and leverage their business efforts in developing purposeful partnerships with higher education to meet the talent demands of the 21st century.

WORK-BASED LEARNING DEFINITION

Work-based learning—such as apprenticeships, internships, externships, co-operative education, and capstone projects—provide students with real-life work experiences. Those experiences allow students to apply academic and technical skills and to develop their employability through career awareness, career exploration opportunities, and career planning activities.

To be successful, however, requires facilitation by a third-party intermediary. Thus, in collaboration with its membership of CEOs, college and university presidents, and other leaders dedicated to the education of a highly skilled future workforce, BHEF has been leading the creation of strategic business-higher education partnerships that focus on providing work-based learning experiences and developing sustainable talent ecosystems that address regional needs for diverse STEM and digital skills.

To date, BHEF has created dozens of partnerships and more than 50 new academic programs—including concentrations, minors, majors, and professional science master's degrees—to meet workforce demands for such skills. This report highlights six case examples of those partnerships and programs.

The first case example describes BHEF's initial application of the Partnership Implementation Process with the University of Maryland, College Park and its lead company, Northrop Grumman Corporation. BHEF's success in facilitating that partnership, which created the nation's first honors program in cybersecurity, served as the foundation for its work on the remaining five case examples.

Supported by a five-year grant from the National Science Foundation, BHEF has focused those five other partnerships on improving student persistence and graduation rates, as well as the transfer of community college students, particularly women and underrepresented minorities, to four-year institutions. Using a common process and elements, including outcome metrics and a community of practice centered on industry's needs and higher education's response, the partnerships in each region engaged businesses in the development of new STEM undergraduate pathways. Together, they created a network of organizations committed to collaborating to increase the supply and diversity of potential employees with vital STEM and digital skills.

A lead employer anchored each of these networks, or ecosystems, which included other regional companies, a lead academic institution, and community colleges from which students transferred. Each partner understood that building a pool of local talent would benefit all stakeholders and potentially result in attracting more businesses and increased demand for such talent in the region. Taking place in multiple areas, the partnerships also demonstrated the various roles that business and higher education can play in community development, job creation, and increased social mobility—particularly in disadvantaged communities. In addition, they showed how seemingly small projects, catalyzed by the efforts of a lead company or higher education institution, can significantly impact the development and growth of STEM and digital convergence in regions far beyond their own.

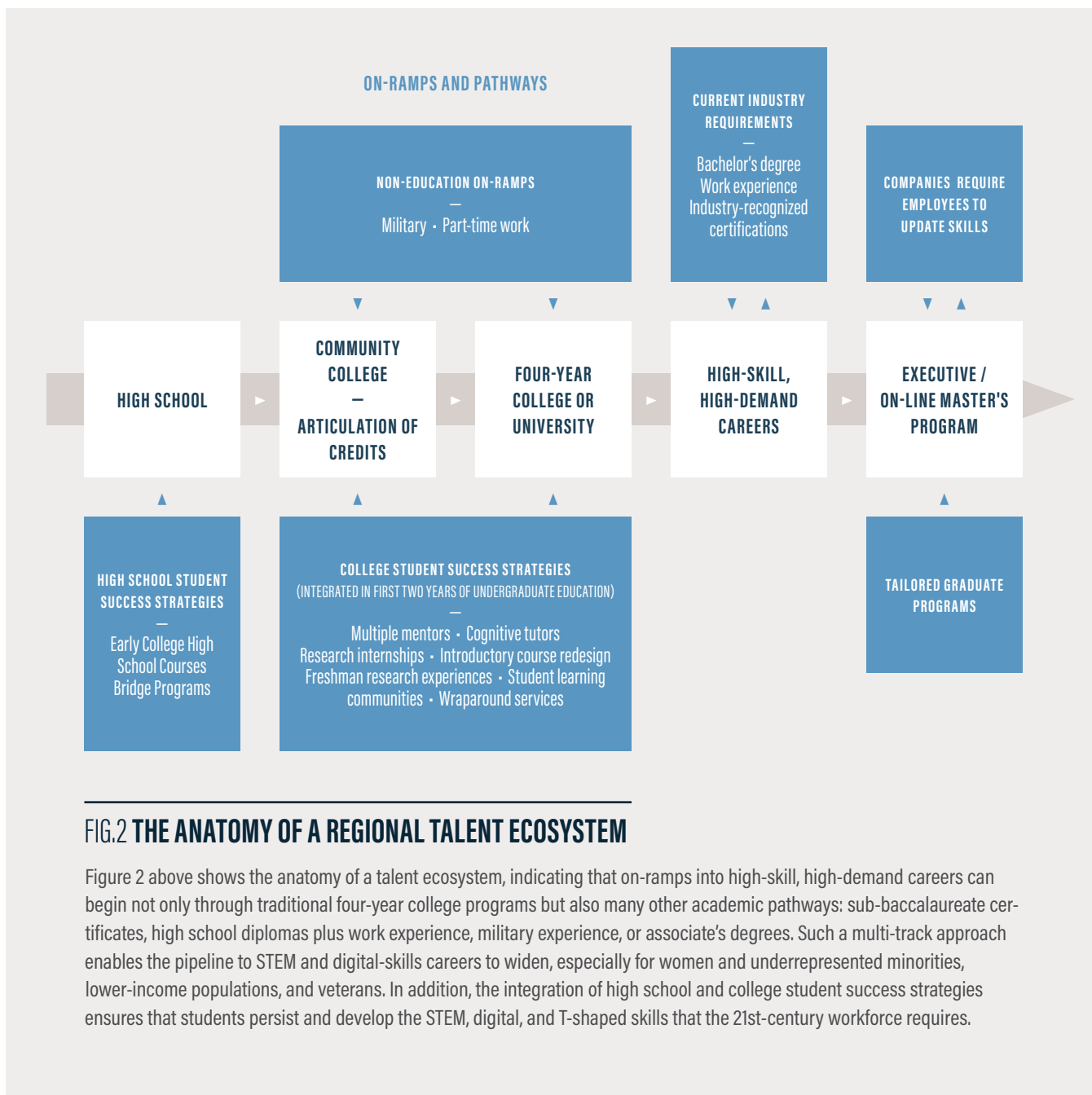


FIG.2 THE ANATOMY OF A REGIONAL TALENT ECOSYSTEM

Figure 2 above shows the anatomy of a talent ecosystem, indicating that on-ramps into high-skill, high-demand careers can begin not only through traditional four-year college programs but also many other academic pathways: sub-baccalaureate certificates, high school diplomas plus work experience, military experience, or associate's degrees. Such a multi-track approach enables the pipeline to STEM and digital-skills careers to widen, especially for women and underrepresented minorities, lower-income populations, and veterans. In addition, the integration of high school and college student success strategies ensures that students persist and develop the STEM, digital, and T-shaped skills that the 21st-century workforce requires.

Although the process for creating such partnerships was not novel prior to the grant, the National Science Foundation's investment enabled BHEF to replicate, bring to scale, and test that process simultaneously across multiple regions for the first time— demonstrating how it could be successfully implemented in diverse settings and contexts.

Now in their fourth year, the partnerships include:

- **The City University of New York and IBM:**
Capitalizing on Existing Infrastructure to Support Transfer Students in Data Science and Analytics and Urban Sustainability

- **Miami Dade College and NextEra Energy:**
Developing Stackable Credentials in Data Science and Analytics
- **Northeastern University, Raytheon, IBM, and Others:**
Integrating Work and Learning in Industry-Informed IT and Cybersecurity Curriculum
- **University of Wisconsin-Milwaukee and the Water Council:**
Pioneering New Work-Based Learning Model in Water Science Program
- **Washington University in St. Louis and Boeing:**
Providing Alternative Engineering Pathway for Nontraditional Students

THE PARTNERSHIP IMPLEMENTATION PROCESS

BHEF'S PARTNERSHIP IMPLEMENTATION PROCESS stems from BHEF's Strategic Business Engagement Model, which is an approach to move business engagement with higher education from merely a transactional to deeply strategic relationship. Traditional models of business engagement are limited to low-touch, piecemeal interactions with higher education, such as on-campus recruiting and research support for business products and services.

BHEF's Strategic Business Engagement Model shifts from that approach to one in which five corporate levers—corporate/executive leadership, corporate philanthropy, employee engagement, core competencies and expertise, and research and development facilities—reinforce one another and work together to improve educational outcomes and workforce alignment.

Building upon that model, BHEF developed a correlated effort—the Partnership Implementation Process—outlining a series of steps and milestones to guide the development of business-led engagement with higher education. This process encourages the replication of effective business-led partnerships, creating a community that contributes to larger state, regional, and national efforts to close the gap between the supply and demand for workforce talent. Given the variety of differentiating factors that exist within each partnership engagement—including the specific industry sectors, companies, and community needs—the process serves as a common, guiding means of not only facilitating change but also sharing outcomes. This common process is replicable and scalable. It does not create a single one-size-fits-all program but rather a blueprint for moving partnerships from needs assessment to changed hiring practices—all of which must be guided by a third-party intermediary playing a coordinating and oversight role that is necessary for success.

BHEF'S STRATEGIC BUSINESS ENGAGEMENT MODEL

Five corporate levers reinforce one another and work together to improve educational outcomes and workforce alignment.

CORPORATE/
EXECUTIVE
LEADERSHIP

CORPORATE
PHILANTHROPY

EMPLOYEE
ENGAGEMENT

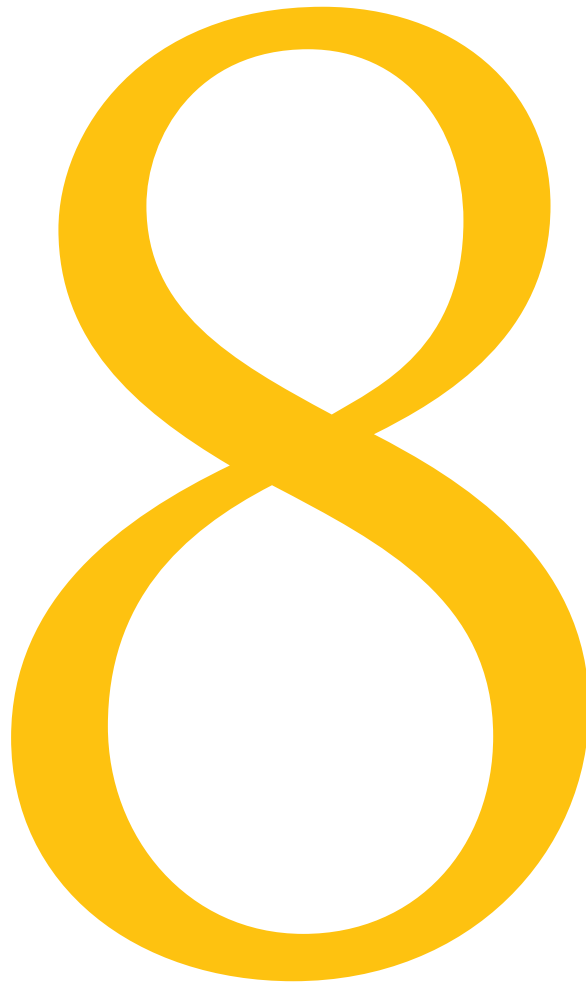
CORE
COMPETENCIES
AND EXPERTISE

RESEARCH AND
DEVELOPMENT
FACILITIES

GUIDING THEMES

THE KEY STEPS OF THE PROCESS are outlined in Figure 3 and described in more detail below, serving as a playbook for replication. When deploying the Partnership Implementation Process, business leaders should consider the following guiding themes:

- **A third-party intermediary** ensures that everyone involved can contribute their direct area of expertise to the process. For example, while businesses do not need to create education products, they can signal their workforce needs and empower higher education providers to develop aligned solutions. Helping define and establish each partner's appropriate role, and the specific contributions they should make to the partnership, requires the broad perspective that only an unaffiliated third party can provide.
- A company's most valuable contribution to a higher education provider is to employ **clear signaling mechanisms** as to its workforce needs. Examples include job postings that accurately reflect company requirements, an ideal candidate profile, or a common language developed through a competency map. Clarity around both short- and long-term needs allows higher education institutions to respond significantly faster than prevailing perceptions of their ability to do so.
- **The C-level executive** plays an essential role in driving change. The process for strategic engagement works best when top executives are facing talent and skills shortages that jeopardize the company's short- and long-term potential and capabilities. The process is also most successful when they pursue a grow-your-own talent strategy based on the specific needs of their economic region. Such a top-down leadership approach, coupled with an on-the-ground implementation process, has proven to be effective and widely applicable.
- **The Partnership Implementation Process** should be viewed as an effective way to develop tangible on-the-ground programs that exemplify the partnership approach. This process enables a partnership to serve as a model for executives at other companies to follow. It also provides the necessary foundation for change upon which a company can anchor broader business-driven conversations around workforce and talent needs. Otherwise, any partnership efforts may come across as isolated or small-scale, lacking the broader platform to drive large-scale disruptive change.



ESSENTIAL STEPS

Any company or higher education institution interested in engaging in a strategic partnership should be aware of eight steps that are essential for success. We've described them briefly on the next few pages.

STEP 1 **Analyze** Job Market Landscape and Skills

The first step is to analyze the workforce requirements in the field and geographic region(s) under consideration. This landscape analysis provides a detailed understanding of the job requirements within and across sectors. It also justifies the level of investment a college or university must make to launch new academic programs or pathways, as well as serves as a table-setting document for the parties involved to commonly define talent needs across fields. 🔍

STEP 2 **Profile** Competencies and Skills

With an understanding of the job market in place, the next step is to identify the skills required of the ideal job candidate. This step entails close collaboration between a higher education institution and a business partner who is attuned to hiring needs. Business partners should come to consensus with their educational counterparts about the job competencies required at different levels across a company, sector, or field. Together, they should design a competency map that identifies the specific skills, knowledge, abilities, and attributes required to operate effectively as a digital-skills-enabled graduate. The competency map establishes a framework to clarify the capabilities expected, facilitating communication among employers, educational institutions, graduates, and other stakeholders. It also integrates short- and long-term workforce needs, including both soft and technical skills. This common language and framework, enabled by decision makers coming to the table and voicing their direct needs, has become the essential element to driving change. 👤

STEP 3 Map Skills and Curricular Gaps

The next step is to examine the current course offerings and degree programs at the college or university. With business' needs clearly defined, education providers can now map to those needs—identifying the courses, programs, and pathways that are already available, as well as any gaps and opportunities for new industry-recognized credentials. ⚙️

STEP 4 Select Academic Credentials

Based on the needs of the employer(s) in the region and the completed gap analysis, partners must then work together to determine the best academic vehicle or vehicles to meet their needs, which should then ultimately lead to industry-recognized credentials. Such academic vehicles may include traditional credentials like four-year degrees, majors, minors, concentrations, applied master's, or associate's degrees. The credentials may be stackable in nature, bridging high school, community college, baccalaureate, and advanced degrees. They may also recognize work-based learning or on-the-job training in new and innovative ways, tying them to credit at postsecondary institutions. The development of new centers, honors colleges, institutes, pathways, or badges are also options.

Consideration should be paid to the flexibility within a higher education institution to propose agile and innovative programs, the response time required to develop the educational programs, and the validation and recognition that the industry partner can provide. That is particularly the case when approaching new fields that are transdisciplinary in nature. It is essential to find the appropriate academic department or structure that fosters rapid response, provides opportunity for dynamic changes as fields emerge, includes faculty expertise across multiple disciplines, and offers industry-recognized credentials. ✔️

STEP 5 Integrate High Impact Practices


Once the partners have selected an appropriate credentialing vehicle, the next step is to build in ongoing applied learning for students and relevant engagement opportunities for businesses. The development of intentional and ongoing engagement facilitates a long-term connection between the employer and the program. Opportunities include providing new work-based learning and research opportunities as well as mentoring programs and scholarships for students. Company executives can also serve on advisory boards and annual curricular reviews committees or as adjunct faculty members or guest lectures at the higher education institution. Such services should be structured to include on- and off-campus opportunities, so they can be delivered not only through formal educational structures but also through informal clubs and student groups. All the business partner's activities should be interconnected through a central plan to engage students, support faculty, and align with all facets of the university—from the president's office to the career center. ☞

STEP 6 Develop Industry-Engaged Programs

The partnership should result in a program that develops well-rounded, T-shaped professionals for the 21st-century workforce. Once that occurs, the college or university should formally launch the new program or pathway, and the business partners should develop a strategy for continued involvement with that program or pathway. Partners should create a central document that articulates the elements of an ongoing engagement strategy that includes success metrics for evaluating the program and gauging its return on investment. ☞


STEP 7

Update Curriculum Continuously

Digital fields are both rapidly evolving and developing. Partnership programs must have mechanisms in place so they can continuously update and change over time. That can include yearly curricular reviews, renewed alignment of educational programs with industry badges and certifications, and additional partnerships with new content providers with additional expertise. 

STEP 8

Change Talent Development and Recruitment

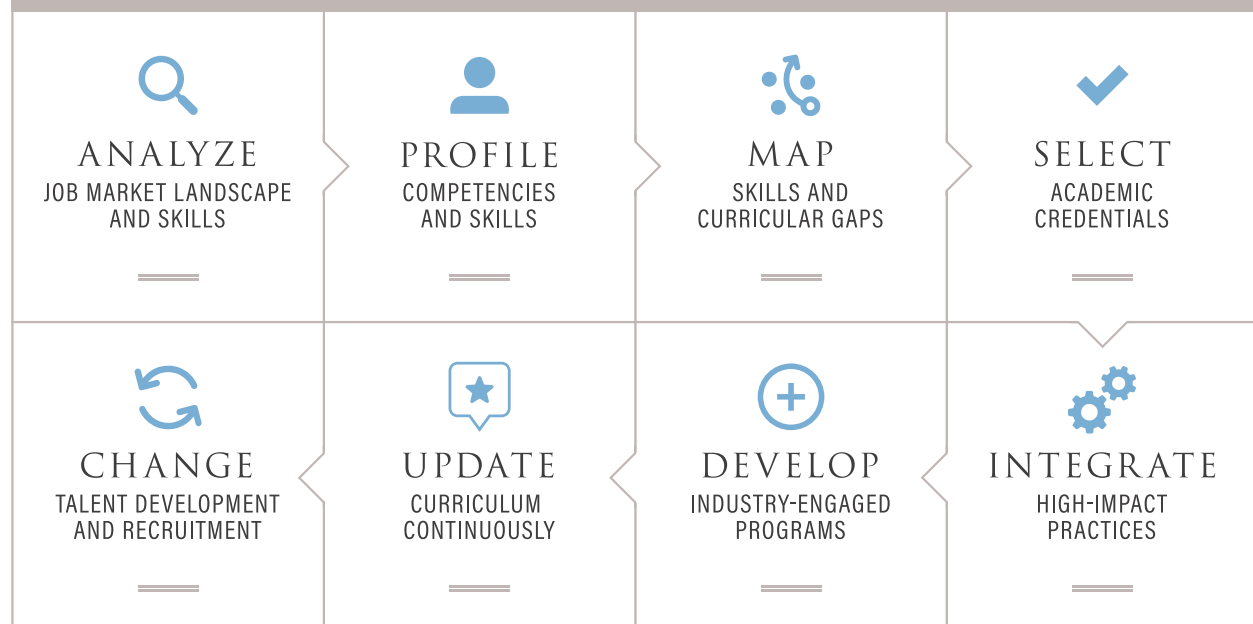
In the last step of the process, business partners should revise and adapt their talent development and recruitment models based on their engagement with their academic partner. For instance, they might reexamine job posting language and requirements to ensure proper signaling as well as their connections to career centers and human resources departments. Once higher education builds the programmatic offerings in response to employer's needs, it is essential that businesses align their programs and activities internally with those offerings to recognize and hire the institution's students and graduates. It is also important for the companies to streamline their hiring, training, recruiting, and retention of talent, as well as to develop measurable outcomes to inform human capital planning based on the partnerships. This final step serves as a feedback loop to the executive office, ensuring that the change process continues and goes both ways. 

PARTNERSHIP CHECKLIST

- ☐ **Select Field or Sector**
(based on Step 1).
- ☐ **Select Geographic Region**
(based on Step 1).
- ☐ **Select Academic Vehicle**
(based on Steps 2, 3, and 4).
- ☐ **Develop Industry Engagement Strategy**
(based on Steps 5, 6, and 7).
- ☐ **Evaluate Company Signaling**
Ensure Candidate Onramps
(based on Step 8).

Throughout these steps, BHEF serves as a third-party facilitator, creating the foundation for the partnerships to develop new credentials, talent pathways, aligned talent acquisition strategies, and a workforce with the skills that companies need.

FIG.3 BHEF STRATEGIC ENGAGEMENT MODEL PARTNERSHIP IMPLEMENTATION PROCESS



The following BHEF-led partnerships demonstrate the application of this proven process in developing diverse regional talent ecosystems in emerging digital fields. They also provide a series of insights that other businesses can use to develop successful partnerships in their own regions.

BHEF-LED CASE EXAMPLE

THE UNIVERSITY OF MARYLAND, COLLEGE PARK AND NORTHROP GRUMMAN CORPORATION

Developing the Nation's First Honors Program in Cybersecurity

Working with its membership, BHEF partnered with University System of Maryland to build a system-wide response to the state's and nation's cybersecurity workforce challenges. Together, all partners have created vibrant and relevant educational programs at five system campuses to meet the needs of the cybersecurity industry. They serve as proof of principle for the Partnership Implementation Process and have resulted in BHEF's leadership in cybersecurity in the District of Columbia, Maryland, and Virginia region.



THE SYSTEM'S PATHWAYS grew out of a series of planning activities, studies, and regional workforce assessments highlighting the need to sharply increase student graduation rates in STEM fields—notably in cybersecurity and particularly among women and underrepresented minorities—to meet the state's rapidly expanding workforce needs. These findings led to the creation of new university programs explicitly designed to address the workforce supply-and-demand gaps in the region as well as the needs of diverse undergraduate student groups.

In particular, the University of Maryland, College Park, the flagship campus of the system, created the nation's first honors program in cybersecurity within its Honors College, the Advanced Cybersecurity Experience for Students (ACES). With the support of a \$1.1 million gift from the Northrop Grumman Foundation, ACES comprises two linked programs: a two-year living-learning program and a two-year minor. Upon graduation, students receive a citation on their Honors College transcript indicating their participation in the ACES program. Employers recognize this citation as a meaningful credential in the hiring process. Students from the program are recruited nationwide and are regarded as among the top cybersecurity talent in the country.

In Maryland, Northrop Grumman and other corporations had immediate needs for increasing the pipeline of top cybersecurity talent. At the same time, the University System of Maryland identified a strategic objective to better align its educational programs to meet state cybersecurity workforce needs. Through conversations brokered by BHEF, Northrop and the system recognized the extent to which their interests intersected. Those common interests and synergies motivated the two parties to design and implement the ACES program in less than two years, a pace of change that outstrips the slower speed traditionally associated with higher education.

Northrop Grumman played a vital role in developing and implementing ACES by advising on curriculum design, encouraging employees to serve as adjunct faculty and mentors, and generously funding a cybersecurity laboratory to allow students, faculty members, and industry representatives to research and collaborate. ACES also has an unusual partnership with the National Security Administration, which provides instructors and mentors to the program as well as hires students for uncleared internships. In addition, ACES has formed partnerships with Leidos, Talos, Parsons, and other nearby companies and government agencies, creating a vibrant network of expertise and opportunities. Partners provide feedback about the ACES' curriculum, host internships, and participate in networking events with students. Through their ongoing involvement with the program, these business partners build relationships with talented students whom they often recruit into full-time positions upon graduation.

PARTNERSHIP CHECKLIST

- ☒ **Select Field or Sector:** Cybersecurity
- ☒ **Select Geographic Region:** Mid-Atlantic (Maryland)
- ☒ **Select Academic Vehicle:** Transcript Citation and/or Minor
- ☒ **Develop Industry Engagement Strategy:** Adjunct Faculty and Instructors, Internships, Mentorship, Co-Developed Curriculum, Networking Events, Cybersecurity Lab, Sponsorship Gifts
- ☒ **Evaluate Company Signaling Mechanisms:** Ongoing

THE CITY UNIVERSITY OF NEW YORK AND IBM

Capitalizing on Existing Infrastructure to Support Transfer Students in Data Science and Analytics and Urban Sustainability

A Burning Glass market analysis has predicted annual job openings for DSA roles will rise steadily to 2.72 million postings in 2020, and according to BHEF's Financial Services Workforce Project, the financial services industry in New York City, in particular, is increasingly demanding DSA skills. In partnership with IBM, the City University of New York, the public university system of New York City, developed the Transformational Research and Experiential Learning for Leadership (TRELLIS) project to support STEM students transferring from community colleges to the City College of New York to complete four-year degrees in high-skill, high-wage fields for the digital economy. Focused on data science and urban sustainability science, the TRELLIS program's researchers train participating students at the Advanced Science Research Center, the university system's state-of-the-art facility for interdisciplinary science.



RECRUITING FROM THE SYSTEM’S seven community colleges, the TRELLIS project organizes outreach and networking events featuring representatives from IBM and other partners. The project consists of three key components: (1) a three-week summer bridge program in New York City where students train in the fundamentals of data analysis and computer programming through work on guided research projects on climate change, (2) a senior capstone research or design project during the academic semester under the guidance of faculty or a summer research internship focused on scientific visualization and advanced environmental data analysis, and (3) a peer mentoring program that matches each summer bridge program student with a senior student who has successfully transferred from community college and is concurrently working on a capstone research project in environmental analytics. The summer bridge program helps prepare STEM transfer students with the foundational math skills they lack, using real-world datasets. Meanwhile, IBM’s partnership, including curriculum development and program presentations, ensures strong industry connections.

The TRELLIS project plays a significant role in BHEF’s larger New York City talent ecosystem. In particular, with support from the Alfred P. Sloan Foundation, the City University of New York’s efforts informed BHEF’s New York City Data Science Task Force, which comprises more than 50 DSA subject matter experts from business, government, and higher education. The task force developed a competency map and built partnerships and programs that met regional workforce needs. In addition, BHEF’s Financial Services Workforce Project—in partnership with members of the Business Roundtable, and other companies, as well as the university system’s Baruch College Zicklin School of Business—focused on developing the data science and analytics, cybersecurity, and risk competencies that financial services organizations increasingly need.

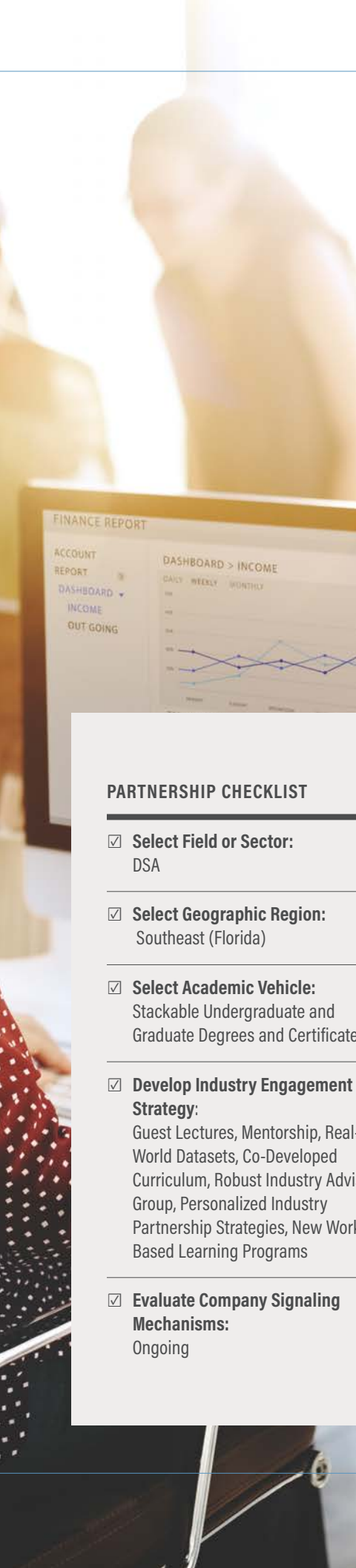
PARTNERSHIP CHECKLIST

- ✓ **Select Field or Sector:**
DSA and Urban Sustainability Science
- ✓ **Select Geographic Region:**
Northeast (New York)
- ✓ **Select Academic Vehicle:**
Undergraduate Credential
- ✓ **Develop Industry Engagement Strategy:** Presentations, Real-World Datasets, Co-Developed Curriculum, Outreach and Networking Events, Summer Bridge Program, Internships
- ✓ **Evaluate Company Signaling Mechanisms:** Ongoing

MIAMI DADE COLLEGE AND NEXTERA ENERGY

Developing Stackable Credentials in Data Science and Analytics

Miami Dade College, traditionally a community college and the largest degree-granting institution in the country, has developed new stackable credentials in data analytics with its lead partner, NextEra Energy. With support from BHEF and the Business Roundtable, the college brought together a set of corporate partners—including Accenture, Miami Children’s Hospital, Miami-Dade County’s Information Technology Department, Oracle Corporation, SAS Institute, and Siemens Energy—to commonly define the educational competencies most needed across digital science and analytics. An interdisciplinary team of the college’s faculty members and administrators then used the competency map to develop a new curriculum for a suite of industry-recognized stackable credentials.



THOSE CREDENTIALS INCLUDED a one-year certificate program, associate's degree, and data analytics bachelor's degree, resulting in 10 new courses including a capstone. Miami Dade also created a College Training and Development workshop for faculty members who have limited experience with DSA to learn how to teach research methods using data analytics concepts like forecasting, inventory modeling, and optimization across all disciplines at the institution.

In the introductory programming course for the data analytics degree, students join a learning community that fosters relationships with faculty members. Students also begin a two-semester undergraduate research experience, which they can continue over the summer semester. Miami Dade provides stipends for nontraditional and commuter students who choose to engage in summer research, while the industry partners contribute real-world datasets, guest lectures, and mentoring opportunities to the summer research experience.

The state of Florida granted Miami Dade permission to offer a one-year analytics certificate and an associate's degree aligned with the state's first and only undergraduate bachelor's degree in data analytics. In addition, through an articulation agreement, Miami Dade's graduates can enroll in a one-year master's program at Florida International University. These stacking academic credentials provide a distinct model for supporting students as they progress in their chosen pathways, allowing employers to match talent at all levels of development and meet the region's need for employees with skills in digital science and analytics. In addition, given that 69 percent of its students work while attending college and 20 percent work full-time, Miami Dade is pioneering connections between work and learning through new-age apprenticeships and internships.

PARTNERSHIP CHECKLIST

- ☒ **Select Field or Sector:**
DSA
- ☒ **Select Geographic Region:**
Southeast (Florida)
- ☒ **Select Academic Vehicle:**
Stackable Undergraduate and Graduate Degrees and Certificates
- ☒ **Develop Industry Engagement Strategy:**
Guest Lectures, Mentorship, Real-World Datasets, Co-Developed Curriculum, Robust Industry Advisory Group, Personalized Industry Partnership Strategies, New Work-Based Learning Programs
- ☒ **Evaluate Company Signaling Mechanisms:**
Ongoing

NORTHEASTERN UNIVERSITY, RAYTHEON, IBM, AND OTHERS

Integrating Work and Learning in Industry-Informed IT and Cybersecurity Curriculum

To meet the region's demand for cybersecurity-related jobs, Northeastern University, a private research university in Boston, has partnered with Raytheon, IBM, and other industry leaders to create an industry-informed curriculum in IT with a focus on cybersecurity. The goal is to increase the transfer, persistence, and completion rates of students from Massachusetts community college programs who transfer into one of the university's Lowell Institute School's degree completion programs, such as the bachelor of science in information technology. Northeastern's College of Professional Studies builds on the university's history as a leader in work-based learning, providing a comprehensive approach to helping students learn and successfully complete their degrees. That approach includes the use of cohorts and mentoring, which is particularly important for nontraditional students who may lack the residential, place-based connection that traditional students experience.



CO-HOSTED WITH BHEF, Northeastern held a cybersecurity industry roundtable on creating aligned and relevant pathways for students when developing curricula. It also partnered with Shearwater International, a local start-up company with expertise in online student support programs, to build a three-tiered mentoring program that would engage students with industry representatives, alumni, and peers. In addition, the university worked with its industry partners, including Boston Children's Hospital, Brigham and Women's Hospital, and Raytheon, to host a speaker series.

Along with that speaker series, Northeastern launched a STEM seminar that enabled students to make informed decisions about their future careers. The university's academic advising and career planning conversations with students has allowed them to reflect on their academic pathways and the relationship of those pathways to their career goals.

Finally, Northeastern also collaborates with its community college partners to align its curriculum with business needs, incorporate high-impact practices, and develop an experiential network project—one that will provide a scalable and sustainable model for further industry engagement in experiential learning. This curriculum also builds on the university's efforts to create new models for industry-recognized credentials. Those include a collaboration with IBM to recognize IBM digital badge credentials as counting toward graduate degrees and a partnership with General Electric to launch an accelerated Bachelor of Science in Advanced Manufacturing Systems program.

PARTNERSHIP CHECKLIST

- ✓ **Select Field or Sector:**
IT and cybersecurity
- ✓ **Select Geographic Region:**
Northeast (Massachusetts)
- ✓ **Select Academic Vehicle:**
Undergraduate Degree
- ✓ **Develop Industry Engagement Strategy:**
Speaker Series, Mentoring Program, Co-Developed Curriculum, Industry Roundtable, Industry-recognized badges, New Work-Based Learning Programs
- ✓ **Evaluate Company Signaling Mechanisms:**
Ongoing

UNIVERSITY OF WISCONSIN-MILWAUKEE AND THE WATER COUNCIL

Pioneering a New Work-Based Learning Model in Water Science Program

Building on Milwaukee's reputation as a water-centric city, the University of Wisconsin-Milwaukee School of Freshwater Sciences, the nation's only graduate school of freshwater science, collaborated with The Water Council, a nonprofit that brings together the region's freshwater public, private, and academic sectors, to create the WATER SYS-STEM: See Yourself Succeeding in STEM program. The program's goal is to help students transfer from a technical college to a four-year STEM program while gaining both academic and industry experience. The partnership works with three local technical colleges—Gateway Technical College, Milwaukee Area Technical College, and Waukesha County Technical College—to recruit interested first-generation, low-income, or underrepresented students who have completed at least one year of technical college in a water-related major.



A CCEPTED STUDENTS ARE PAIRED WITH A FACULTY member and an industry mentor. For 10 weeks during the summer, the students participate in several research experiences. In the first week, they engage in experiential activities, such as expeditions to Lake Michigan and discussions about professional decorum for internships and networking. Students then have an eight-week paid internship, following which they revisit Lake Michigan, debrief about their internships, and develop their presentation skills during a summer research symposium with oral and poster presentations.

The program's curriculum focuses on repeated, hands-on experience in real-world research and exposure to personal and professional development through seminars, discussions, and on-site visits. Students from previous cohorts also serve as peer mentors. Altogether, this program represents a new-age, work-based learning program that is a hybrid of an apprenticeship, internship, and research experience combined.

Business partners from The Water Council—including Advanced Waste Services (now COVANTA Environmental Solutions); Badger Meter; City of Milwaukee Health Department; City of Racine Health Department; Evoqua Water Technologies; GRAEF Engineering, Planning, and Design; Milwaukee Metropolitan Sewerage District; Sage Water; and Watertech of America, Inc.—offer paid internships. In addition, The Water Council is working to provide students with mentorships and exposure to diverse technologies—drawing from its network of more than 200 water technology business members. It has also helped define this transdisciplinary field by identifying and detailing its workforce needs and connecting those needs to university degrees. In return, this program is providing The Water Council's mainly small- and medium-sized companies access to a vital source of diverse talent that otherwise would not have been available.

PARTNERSHIP CHECKLIST

- ☒ **Select Field or Sector:**
Water Science
- ☒ **Select Geographic Region:**
Midwest (Wisconsin)
- ☒ **Select Academic Vehicle:**
Undergraduate Credential
- ☒ **Develop Industry Engagement Strategy:**
Internships, Mentorship, On-Site Visits, Exposure to Diverse Technologies, New Models for Work-Based Learning
- ☒ **Evaluate Company Signaling Mechanisms:**
Ongoing

WASHINGTON UNIVERSITY IN ST. LOUIS, UNIVERSITY OF MISSOURI-ST. LOUIS, AND BOEING

Providing Alternative Engineering Pathway for Nontraditional Students and Changing a Company's Approach to Cultivating Local Talent

Washington University in St. Louis, a private research university, has partnered with the University of Missouri, St. Louis, a large public university, to provide low-cost, high-quality, and ABET-accredited undergraduate engineering degrees through its Joint Undergraduate Engineering Program. Many students begin the program by completing introductory material and scientific foundational course work at either University of Missouri, St. Louis or a local community college, such as St. Louis Community College, before transferring to Washington University to take upper-division engineering courses.



BOEING, A MAJOR EMPLOYER IN THE ST. LOUIS REGION, has partnered with and built upon the undergraduate engineering program to create the Boeing-Washington University Joint Engineering Leadership Development Program, realigning its talent strategy and opening up alternative pathways for students into Boeing careers. Before this partnership, Boeing had relationships with the local community colleges for technical programs and recruited heavily from Washington University for its engineering and technical hires. But those recruitment and investment strategies were separate and not part of an overarching coordinated pathway.

Boeing has made linked investments to support students as they move from community college to completing their four-year degrees, including providing scholarships, mentors, internships, and other supports to build a pipeline of qualified and diverse local job candidates—many of whom are offered positions in the company upon graduation. At the same time, the partnership has changed Boeing internally, expanding its recruitment to include two-year colleges and accelerating its hiring initiatives.

As a result, the program has created career pathways for a previously untapped source of diverse talent, positioned Boeing as a regional leader in cultivating local engineering expertise and resulted in a program pathway that serves as the foundation for a regional engineering talent ecosystem that other employers can leverage. This successful partnership with Boeing has also provided Washington University with proof points to encourage other local companies—such as Emerson Electric Company, Nidec Motor Corporation, and Ameren Corporation—to join the program and scale it up, thus creating even more opportunities for students.

PARTNERSHIP CHECKLIST

- ✓ **Select Field or Sector:**
Engineering
- ✓ **Select Geographic Region:**
Midwest (Missouri)
- ✓ **Select Academic Vehicle:**
Undergraduate Degrees
- ✓ **Develop Industry Engagement Strategy:**
Adjunct Faculty, Internships, Mentorship, Co-Developed Curriculum, Scholarships, Aligned Partnership Strategy that Coordinates Investments
- ✓ **Evaluate Company Signaling Mechanisms:**
Ongoing

The Boeing Company

Boeing has both middle- and high-skill employment needs in the St. Louis region. It has robust technician programs with community colleges, and its regional engineering recruitment includes a strong focus on Washington University. Boeing President and CEO Dennis Muilenberg constantly stresses the importance of its talent pipeline and a willingness to invest in strategies to improve the company's business.



It's important to note that Washington University has asked Boeing for strategic contributions, rather than transactional ones, to support and diversify students in the program. And Boeing has responded. With a strong commitment at the C-suite level, Boeing has provided time, people, and resources to the development and implementation of the Boeing-Washington University partnership. The company's key contributions and linked investments in the partnership have included co-developing the curriculum and providing internships, mentorship, and adjunct faculty. It has also made a seven-figure financial gift over five years, including \$100,000 per year in scholarship funds for select students.

Boeing prides itself on those meaningful contributions it has made to the partnership. Its mentoring program is preparing students to fill the jobs of its retirees, allowing those students the opportunity to learn from Boeing's employees and Boeing's employees to nurture as well as benefit from the innovative thinking of the next generation of talent. It also created a paid, part-time engineering internship program whereby students engage in high-quality experiential learning by working alongside Boeing's engineers during the day while they continue their courses in the evenings. Further, Boeing is collaborating on curriculum design, such as capstone projects and competitions, ensuring hands-on, real-world learning opportunities that develop and reinforce T-shaped skills like communication and teamwork. In addition, the company is providing adjunct faculty members for courses on topics such as ethics, leadership, and diversity.

The partnership has also given Boeing access to a more diverse and valuable talent pipeline. The company understands that was made possible by the dedication of the leaders at its partner institutions, including Washington University, University of Missouri-St. Louis, and St. Louis Community College, who have been truly invested in ensuring that the next generation of students are prepared for success. That has resulted in an unusual sharing of resources, with a significant portion of Boeing's seven-figure gift to Washington University passed on to the University of Missouri-St. Louis in support of the program.

Boeing's investment is yielding measurable and meaningful outcomes and resulting in changes to its internal practices and priorities. Not only is the company seeing its investment influence students in the program, but it is also hiring more diverse students in the region as a whole—which lays a firm foundation for stronger communities and better business on a larger scale.

In addition, the partnership has catalyzed internal discussions within Boeing on its human-resource strategies, expanding its recruitment from only select four-year academic institutions to two-year college in order to recruit and retain engineers from diverse backgrounds and institutional sources. Because of its importance to the company's leadership, Boeing has also been able to accelerate its hiring initiatives through the partnership, demonstrating the positive impact the program has had on the company as a whole.



INSIGHTS

What can other businesses and higher education institutions learn from the preceding case studies? Through BHEF's in-depth work with the six partnerships, we've identified the following key recommendations for success.

FOCUS PARTNERSHIPS on developing sustainable regional talent ecosystems. Partnerships among four-year public and private universities, community colleges, employers, and other stakeholders should create diverse and sustainable platforms for building and expanding successful new career pathways and job-training programs. By aligning on key objectives and focusing on big-picture results, partners are able to leverage each other's strengths and assets, resulting in a pool of local talent that not only benefits existing companies but also has the potential to attract new employers to the region.

ENGAGE C-SUITE BUSINESS AND ACADEMIC LEADERS to drive change. C-suite executives and academic administrators can use their leadership position to raise community awareness of 21st-century workforce needs and higher education's response to those needs. They can encourage their peers from other companies to also focus on building STEM and digital-skills pathways in support of workforce-development goals. They can guide corporate and academic policy to ensure that both sectors' efforts align with shared goals. Finally, they can serve as champions for creating diverse talent ecosystems.

DEVELOP A COMMON LANGUAGE among partners. Business and higher education leaders in the partnership may possess different visions and goals, so identification and agreement on those goals through a facilitated discussion by a third party such as BHEF is vital. Developing a common language among partners through consensus-building activities, such as competency mapping, helps to translate, clarify, and align expectations, responsibilities, and outcomes to ensure a mutually beneficial partnership. Establishing a common taxonomy for digital fields or other programmatic elements, such as work-based learning, also enables clear and effective communication.

TRANSLATE EMPLOYER-LED PARTNERSHIPS into transformative metrics-driven change. Employer-led partnerships have the power to create both small- and large-scale transformative change. Measuring the extent of such change through the use of metrics ensures that the impact of a partnership is understood and recognized, which serves as further justification for engagement in the partnership, provides insight into areas where improvement is needed, and informs data-driven decisions moving forward.

CREATE WORK-BASED LEARNING PROGRAMS that align with talent and recruiting strategies. High-impact practices, including work-based learning opportunities, are a specific set of educational practices that have been shown through research to substantially benefit undergraduate student engagement, learning, and success through graduation. Each of the higher education institutions in the partnerships that we worked with included such practices in their programming in distinct ways, including embedding them in the required curriculum and capitalizing on their strong relationships with business partners. Companies should invest in those high-impact practices, such as mentor programs, to support students and ensure that work-based learning programs are integrated into their recruitment strategies. By intentionally incorporating such elements as they develop their programs, business and higher education partnership will ensure that the students benefit from the education and training and are well-prepared for the jobs of the 21st century.

CONSIDER THE FOUR-YEAR INSTITUTION an intermediary between business and community colleges. Many companies have highly prescribed practices for how and where they recruit talent, yet they have trouble finding diverse candidates in such traditional job pools. Placing a university partner in the middle of the community college transfer process provides a company with a known academic partner, and the university can ensure that the transfer students receive the support they need prior to transfer and on through graduation. Having the university partner serve as the intermediary helps companies more easily expand their talent recruitment strategies.

REVIEW COMPANY HUMAN-RESOURCE STRATEGIES and human-capital planning to effectively recruit diverse STEM and digital-skills talent. The industry partners that BHEF worked with realized that they should review their human-resource strategies and human-capital planning in light of their support of nontraditional students in STEM and digital-skills programs. For example, Washington University's new engineering pathway sparked internal discussions at Boeing, which typically recruits from selected academic institutions, about the need to recruit and retain engineers from diverse backgrounds and institutions—particularly those who began their academic work at two-year colleges. IBM typically focuses its educational outreach on K-12 STEM, notably through its support of the Pathways in Technology Early College High Schools program, and graduate education through fellowships, technology sharing, and other approaches. Its partnership with the City University of New York has demonstrated the value of engaging at the undergraduate level, particularly at the juncture between two- and four-year STEM programs, to develop diverse talent.

CALL TO ACTION

THE SIX BHEF PROJECTS HIGHLIGHTED IN THIS REPORT are demonstrating the distinct role that businesses can play in collaborating with higher education institutions to develop human capital beyond the traditional modes of interaction—particularly in emerging fields focused on digital convergence. The findings of this report can serve as a playbook for CEOs and their senior executives for developing purposeful and strategic partnerships with higher education that rapidly respond to the need for diverse digital-skills talent. Based on our experiences thus far, we recommend that other companies interested in developing such partnerships:

- **Focus partnerships** on developing sustainable regional talent ecosystems.
- **Engage C-suite business and academic leaders** to drive change.
- **Develop a common language** among partners.
- **Translate employer-led partnerships** into transformative metrics-driven change.
- **Create work-based learning programs** that align with talent and recruiting strategies.
- **Consider the four-year institution** an intermediary between business and community colleges.
- **Review company human-resource strategies** and human-capital planning to effectively signal and recruit diverse STEM and digital-skills talent.

BHEF seeks to expand its efforts to a wider circle of companies, higher education institutions, government agencies, research and development centers, associations, professional societies, and other organizations. Through this report, we hope to inspire more businesses and higher education institutions to take action and replicate these partnerships and their critical project elements to create innovative undergraduate and graduate programs. Such programs can build digital skills and significantly improve student outcomes, including community college transfer, across multiple regions.

The findings of this report can serve as a playbook for CEOs and their senior executives for developing purposeful and strategic partnerships with higher education that rapidly respond to the need for diverse digital-skills talent.



Creating Solutions. Inspiring Action.

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